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Информация о владельце:  
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Должность: Ректор  
Дата подписания: 19.05.2023 16:30:55  
Уникальный программный ключ:  
ca953a0120d891083f939673078ef1a989dae18a

**Federal State Autonomous Educational Institution of Higher Education  
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA  
RUDN University**

**Agrarian and Technological Institute**

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educational division (faculty/institute/academy) as higher education programme developer

## **COURSE SYLLABUS**

**Inorganic and analytical chemistry**

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course title

**Recommended by the Didactic Council for the Education Field of:**

**36.05.01 Veterinary**

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field of studies / speciality code and title

**The course instruction is implemented within the professional education programme of higher education:**

**36.05.01 Veterinary**

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higher education programme profile/specialisation title

## 1. GOALS AND OBJECTIVES OF THE COURSE

The aim of mastering the course "**Inorganic and analytical chemistry**" is to form a systematic knowledge of the structure of matter, the basic laws of chemical reactions, the basic classes of inorganic compounds, the basics of analytical chemistry to use this knowledge as a basis for the study of subsequent courses in organic chemistry, physical and colloid chemistry, biological chemistry.

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

The implementation of the course "**Inorganic and analytical chemistry**" is aimed at creating the following competencies (parts of competencies) for students:

*Table 2.1. List of competencies formed by students during the development of the course (results of the development of the course)*

Competence code	Competence descriptor	Indicators of competence accomplishment (within the course)
GC-8	Is able to create and maintain safe living conditions in everyday life and professional activities to preserve the natural environment, ensure the sustainable development of society, including the threat and emergence of emergencies and military conflicts	GC-8.1 Analyzes factors of harmful influence on the life activity of elements of the environment (technical means, technological processes, materials, buildings and constructions, natural and social phenomena);
		GC-8.2 Identifies hazardous and harmful factors within the scope of the job;
GPC-4	Is able to use in professional activity methods to solve problems using modern equipment in the development of new technologies and use modern professional methodology to conduct experimental research and interpretation of the results	GPC-4.1 Has the conceptual and methodological apparatus of the basic natural sciences at a level sufficient for full professional activity at the modern level
		GPC-4.3 Willing to use modern methodology in designing and conducting experimental research
		GPC-4.4 Uses modern professional methodology in interpreting research results

## 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course "**Inorganic and analytical chemistry**" refers to the mandatory part of block B1 of the Educational Program of Higher Education.

As part of the Educational Program of Higher Education, students also master other courses and /or practices that contribute to achieving the planned results of mastering the course "**Inorganic and analytical chemistry**".

Table 3.1. List of Higher Education Program components courses that contribute to expected learning outcomes

Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
GC-8	Is able to create and maintain safe living conditions in everyday life and professional activities to preserve the natural environment, ensure the sustainable development of society, including the threat and emergence of emergencies and military conflicts	Basics of Professional Ethics	Organic chemistry Biological physics Life safety Veterinary Microbiology and Mycology Virology and biotechnology Veterinary radiobiology General and Veterinary Ecology Study practice Preparation for and passing the state exam
GPC-4	Is able to use in professional activity methods to solve problems using modern equipment in the development of new technologies and use modern professional methodology to conduct experimental research and interpretation of the results		Organic chemistry Biological physics Physical and Colloidal Chemistry Biological chemistry Maths Immunology Laboratory diagnostics of infectious and invasive diseases Veterinary and industrial laboratories with design basics Study practice Clinical internship Industrial practice Academic research practice with the preparation of a scientific qualification project Preparation for and passing the state exam

#### 4. COURSE WORKLOAD AND TRAINING ACTIVITIES

Course workload of the course "**Inorganic and analytical chemistry**" is 3 credits.

Table 4.1. Types of academic activities during the period of the HE program mastering for *full-time* study

Types of academic activities		HOURS	Semesters			
			1	-	-	-
Contact academic hours		51	51	-	-	-
including						
Lectures		17	17	-	-	-
Lab work		34	34	-	-	-
Seminars (workshops/tutorials)		-	-	-	-	-
Self-study		39	39	-	-	-
Evaluation and assessment (exam/pass/fail grading)		18	18	-	-	-
Course workload		Academic hour	108	108	-	-
		Credit unit	3	3	-	-

## 5. COURSE CONTENTS

Table 5.1 Content of the course (module) by type of academic work

Modules	Content of the modules (topics)	Types of academic activities
Module 1. Structure of the atom. Chemical bonding	Topic 1.1 Electronic configurations of atoms and ions.	Lectures, Lab work.
	Theme 1.2 The periodic law of D.I. Mendeleev.	Lectures, Lab work.
	Topic 1.3 The method of valence bonds.	Lectures, Lab work.
	Topic 1.4 Valence.	Lectures, Lab work.
	Topic 1.5 Hybridization of orbitals.	Lectures, Lab work.
	Topic 1.6 Chemical bonding in complex compounds.	Lectures, Lab work.
Module 2. Thermochemistry. Chemical equilibrium.	Topic 2.1 Fundamentals of thermochemistry.	Lectures, Lab work.
	Topic 2.2 Enthalpy.	Lectures, Lab work.
	Topic 2.3 Hess's Law.	Lectures, Lab work.
	Topic 2.4 Entropy.	Lectures, Lab work.
	Topic 2.5 Gibbs free energy.	Lectures, Lab work.
	Topic 2.6 Chemical equilibrium.	Lectures, Lab work.
	Topic 2.7 Law of Action of Masses.	Lectures, Lab work.

	Topic 2.8 Chemical equilibrium displacement.	Lectures, Lab work.
Module 3. Solutions. Electrolytic dissociation	Topic 3.1 General concepts of disperse systems.	Lectures, Lab work.
	Topic 3.2 Ways to express the concentration of solutions: mass fraction, molar concentration, molar concentration of equivalent substances.	Lectures, Lab work.
	Topic 3.3 The theory of electrolytic dissociation.	Lectures, Lab work.
Module 4. Dissociation of weak and strong electrolytes. Hydrolysis of salts	Topic 4.1 Weak electrolytes.	Lectures, Lab work.
	Topic 4.2 The law of dilution.	Lectures, Lab work.
	Topic 4.3 . The common ion effect.	Lectures, Lab work.
	Topic 4.4 Buffer solutions.	Lectures, Lab work.
	Topic 4.5 Strong electrolytes.	Lectures, Lab work.
	Topic 4.6 Activity and activity coefficient.	Lectures, Lab work.
	Topic 4.7 Ionic force.	Lectures, Lab work.
	Topic 4.8 Ionic product of water.	Lectures, Lab work.
	Topic 4.9 Hydrogen Index.	Lectures, Lab work.
	Topic 4.10 Hydrolysis of salts.	Lectures, Lab work.
	Topic 4.11 Dependence of hydrolysis on temperature and solution concentration.	Lectures, Lab work.
Module 5. Heterogeneous equilibria. Coordination compounds.	Topic 5.1 Solubility constant.	Lectures, Lab work.
	Topic 5.2 Solubility.	Lectures, Lab work.
	Topic 5.3 Dissolution and precipitation conditions.	Lectures, Lab work.
	Topic 5.4 Electrolytic dissociation and the instability constant of coordination compounds.	Lectures, Lab work.
Module 6. Redox Reactions	Topic 6.1 Oxidation-reduction reactions.	Lectures, Lab work.
	Topic 6.2 Redox potentials.	Lectures, Lab work.

	Topic 6.3 Nernst equation.	Lectures, Lab work.
	Topic 6.4 Conditioning of redox reactions.	Lectures, Lab work.
Module 7. Basic Classes of Inorganic Compounds	Topic 7.1 Main classes of inorganic compounds.	Lectures, Lab work.
	Topic 7.2 Relationship of inorganic compounds.	Lectures, Lab work.
Module 8. Basics of Qualitative Analysis	Topic 8.1 Fundamentals of qualitative analysis of cations and anions.	Lectures, Lab work.
	Topic 8.2 Determination of cations of analytical groups I - VI and anions of analytical groups I - III in solutions.	Lectures, Lab work.
Module 9. Basics of Quantitative Analysis	Topic 9.1 Fundamentals of Quantitative Analysis.	Lectures, Lab work.
	Topic 9.2 Methods of neutralization, complexometry, oxidimetry and photolorimetry.	Lectures, Lab work.

## 6. COURSE EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Material and technical support of the course

<i>Classroom for Academic Activity Type</i>	<i>Equipping the classroom</i>	<b>Specialized educational/laboratory equipment, software and materials for the development of the course (if necessary)</b>
Lecture	An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a board (screen) and technical means of multimedia presentations.	<ul style="list-style-type: none"> <li>- Chemical Tables</li> <li>- Sets of special chemical tableware</li> <li>- Sets of chemicals</li> <li>- Exhaust cabinets</li> <li>- Drying cabinets</li> <li>- Distillers</li> <li>- Centrifuges</li> <li>- Water baths</li> <li>- Chemical scales</li> <li>- Photolorimeters</li> <li>- Potentiometers</li> </ul>
Laboratory	An auditorium for laboratory work, individual consultations, routine monitoring and interim certification, equipped with a set of specialized furniture and equipment.	<ul style="list-style-type: none"> <li>- Chemical Tables</li> <li>- Sets of special chemical tableware</li> <li>- Sets of chemicals</li> <li>- Exhaust cabinets</li> <li>- Drying cabinets</li> <li>- Distillers</li> <li>- Centrifuges</li> <li>- Water baths</li> </ul>

		- <i>Chemical scales</i> - <i>Photocolorimeters</i> - <i>Potentiometers</i>
Self-studies	An auditorium for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to an electronic information and educational environment.	-

## 7. RESOURCES RECOMMENDED FOR COURSE STUDIES

### *Main readings:*

1. General, inorganic and analytical chemistry : lecture notes for the 1st year students of Agrarian and Technological Institute and Environmental Faculty / M.A. Ryabov, R.V. Linko. - 2nd ed., revised. ; Publishing house of PFUR, 2020. - 93 c. : <https://lib.rudn.ru/MegaPro/Download/MObject/7840>
2. General and inorganic chemistry : in 2 volumes. Volume 1 : Laws and concepts / E. V. Savinkina, V. A. Mikhailov, Y. M. Kiselev [et al] ; edited by A. Yu. Tsivadze. - 2nd ed. - Moscow : Laboratory of knowledge, 2022. - 491 c.
3. Handbook of inorganic chemistry / M.N. Kurasova, M.G. Safronenko, N.Y. Esina [et al.], Moscow : PFUR, 2020. - 105 c. : <https://lib.rudn.ru/MegaPro/Download/MObject/7797>

### *Additional Readings:*

1. Ryabov M. A., Nevskaya E. Yu., Sorokina E. A., Sheshko T.F. Collection of basic formulas in chemistry. - M.: AST: Astril, 2009. 319 c. - (Short reference book of the student).

### *Internet sources*

1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System (RUDN ELS) <http://lib.rudn.ru/MegaPro/Web>
- EL "University Library Online" <http://www.biblioclub.ru>
- EL "Yurayt" <http://www.biblio-online.ru>
- EL "Student Consultant" [www.studentlibrary.ru](http://www.studentlibrary.ru)
- EL "Lan" <http://e.lanbook.com/>
- EL "Trinity Bridge"

### *2. Databases and search engines:*

- electronic foundation of legal and normative-technical documentation <http://docs.cntd.ru/>
- Yandex search engine [https:// www .yandex.ru/](https://www.yandex.ru/)
- Google search engine <https://www.google.ru/>
- Scopus abstract database <http://www.elsevierscience.ru/products/scopus/>

Educational and methodological materials for independent work of students during the development of the course/ module\*:

1. A course of lectures on the course "**Inorganic and analytical chemistry**".

2. Laboratory workshop on the course "**Inorganic and analytical chemistry**".

\* - The training toolkit and guidelines for the internship are placed on the internship page in the university telecommunication training and information system under the set procedure.

## **8. ASSESSMENT TOOLKIT AND GRADING SYSTEM\* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL AS COURSE RESULTS**

The assessment toolkit and the grading system\* to evaluate the level of competences (competences in part) formation as the course results are specified in the Appendix to the course syllabus.

\* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

### **DEVELOPER:**

Associate Professor, Department of General  
Chemistry

Position, Basic curriculum

Signature

Ryabov M.A.

Full name.

### **HEAD OF EDUCATIONAL DEPARTMENT:**

Department of General Chemistry

Name Basic Curriculum

Signature

Davydov V.V.

Full name.

### **HEAD OF HIGHER EDUCATION PROGRAMME:**

Director of the Department of Veterinary Medicine

Position, Basic curriculum

Signature

Vatnikov Yu.A.

Full name